Assigning Your Application an Identity with Code Signing

Session 504

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Assigning Your Application an Identity with Code Signing

Perry the Cynic
Lead Architect, OS Security Group

What's in It for You

- Recognize, filter, and organize groups of code
- System recognizes your software updates
- Resilience against unintended modifications
- Write first-class code
  - Unsigned code is legacy

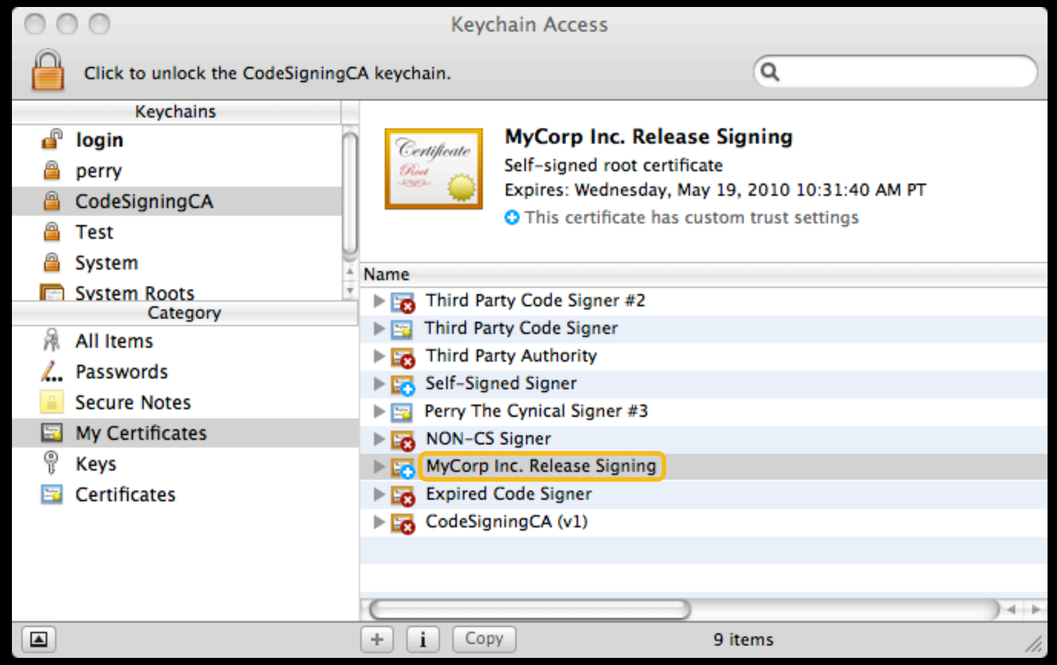
What Code Signing Does

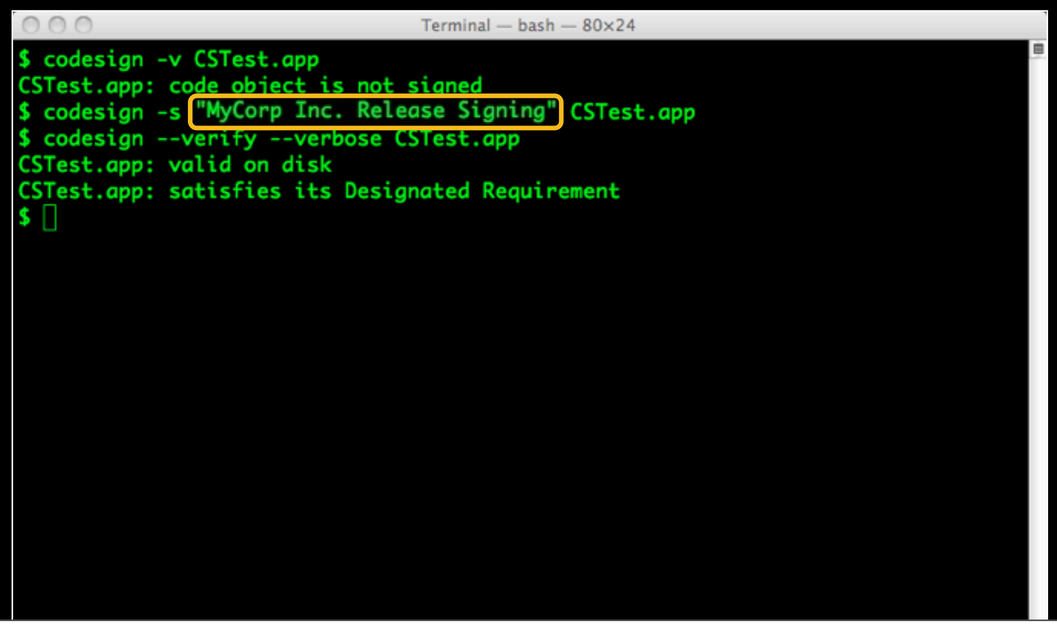
- Define identity for code
- Seal code to detect unintended alteration
- Provides a language for discussing identity
- Reliably identify running code

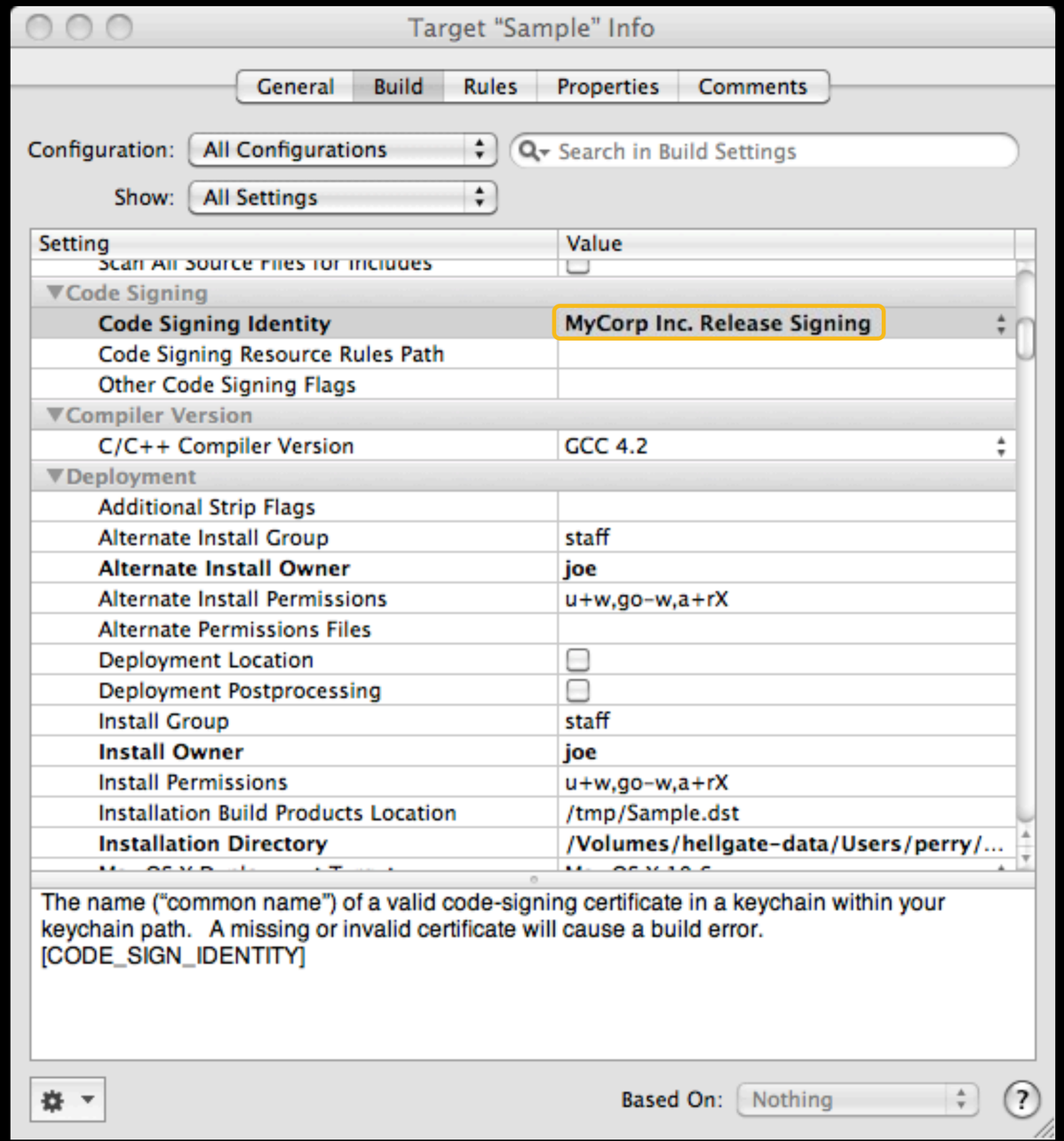
What Code Signing Does Not Do

- Provide privileges
- Protect against bugs
- Protect against misplaced trust

Signing Code in One Slide







Code Signing Is Pervasive

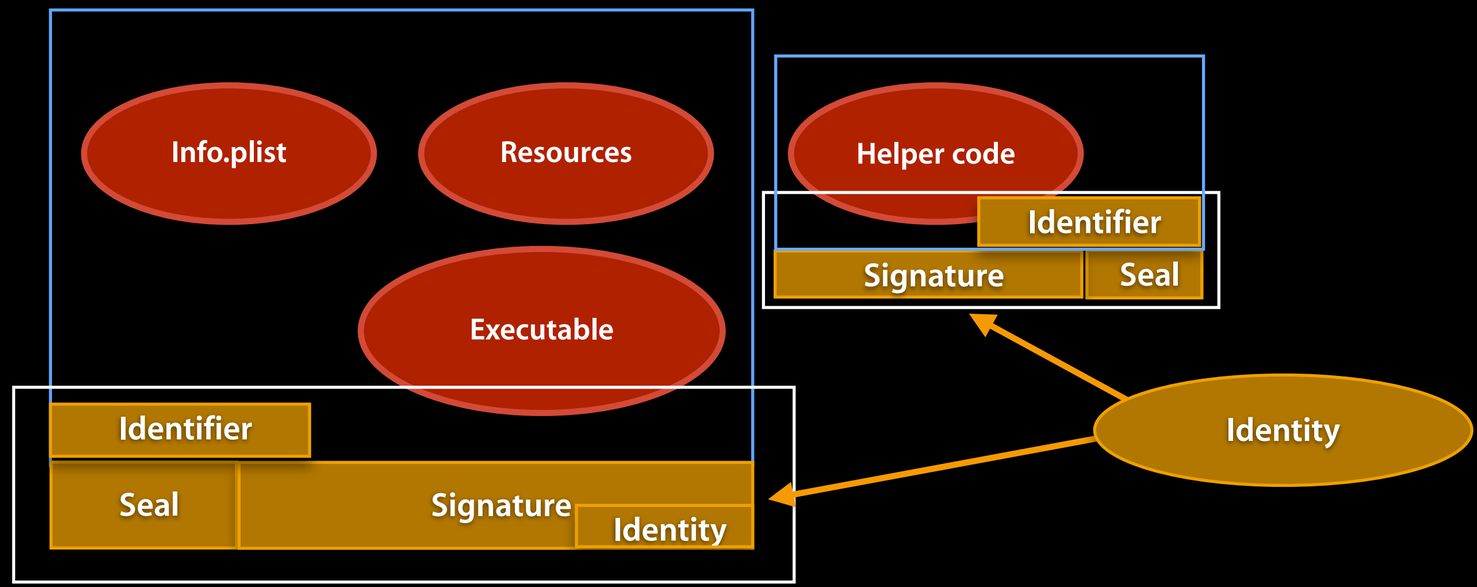
- All kinds of code
  - Programs
  - Libraries and plug-ins
  - Scripts
  - Bundles
  - Extensible
- Dynamic and static validation
- All shipping versions of Mac OS
- Goal: All code on the system is signed

This Is a Runtime Feature

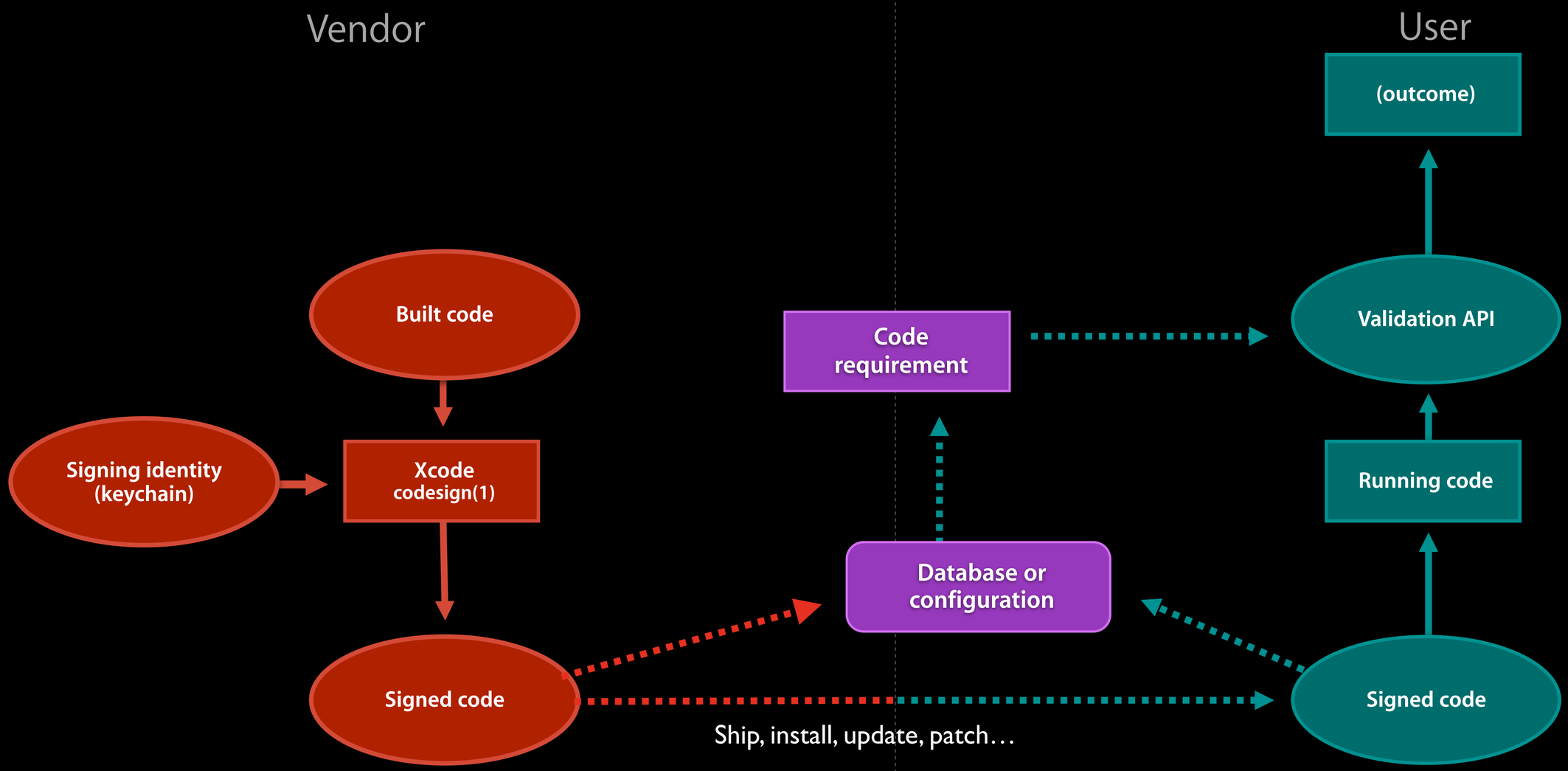
- Primary mission is validation of running code
  - Bind running code to its disk origin
  - Track dynamic validity state
  - Manage hierarchies of managed code (“code hosting”)
  - Put it all together efficiently
- Static validation is just a useful subfunction

Demo

How a Signature Is Built



How a Signature Is Used



Code Requirements

- Filter rules apply to signed code
- Matches features of the code or its signature
- Defines code identity
- Text form (viewing, editing)
- Binary form (storage, application)
- Internal Requirements embedded in signatures

Designated Requirements

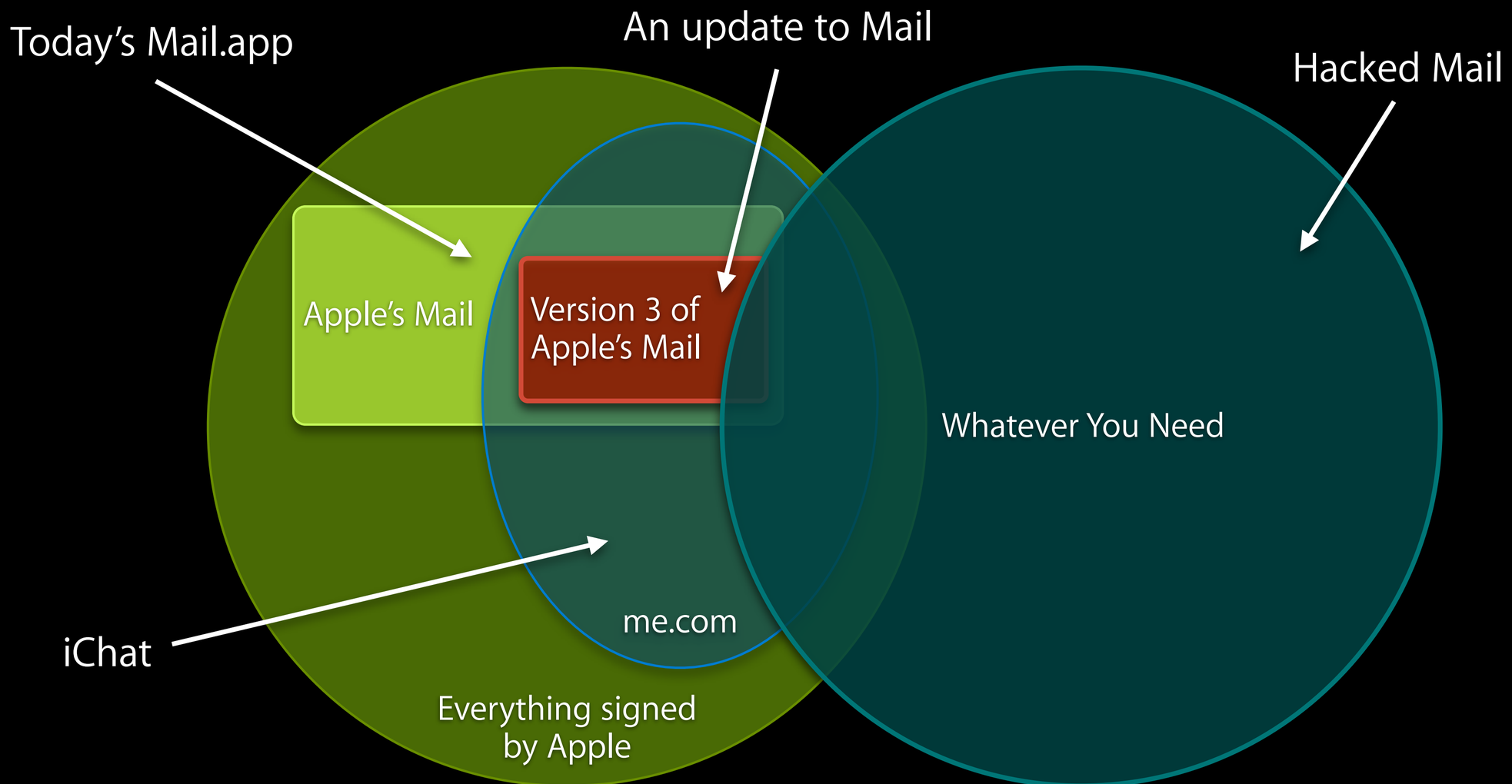
- Retrieved from signed code
- Implicitly generated or explicit by signer
- Explicit definition of “myself”
- Implicit definition of “update”

Code Identity

- Defined by requirement, not signature
- Classes of code (“all code that…”)
  - Even Designated Requirement (“all versions/updates of me”)
- Designated Requirement = self-identification
- One code answers to many identities
- Meaningless to compare signatures
- Code identity ≠ signing identity

Code Identity

(The Picture)

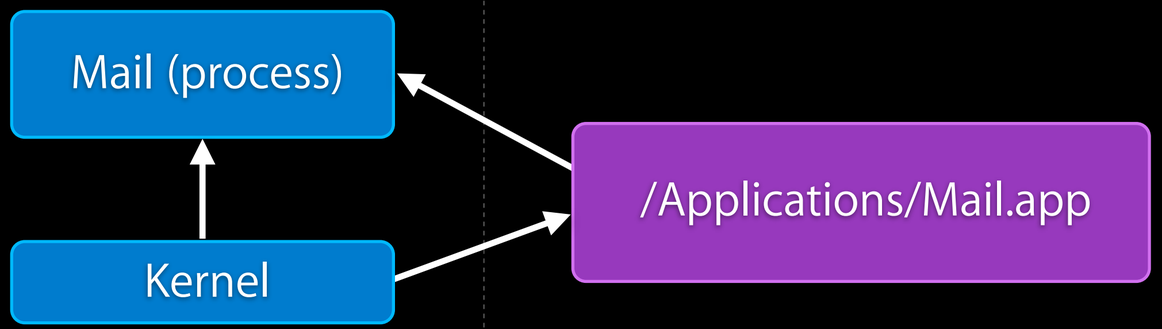


Code Hosting

Running code

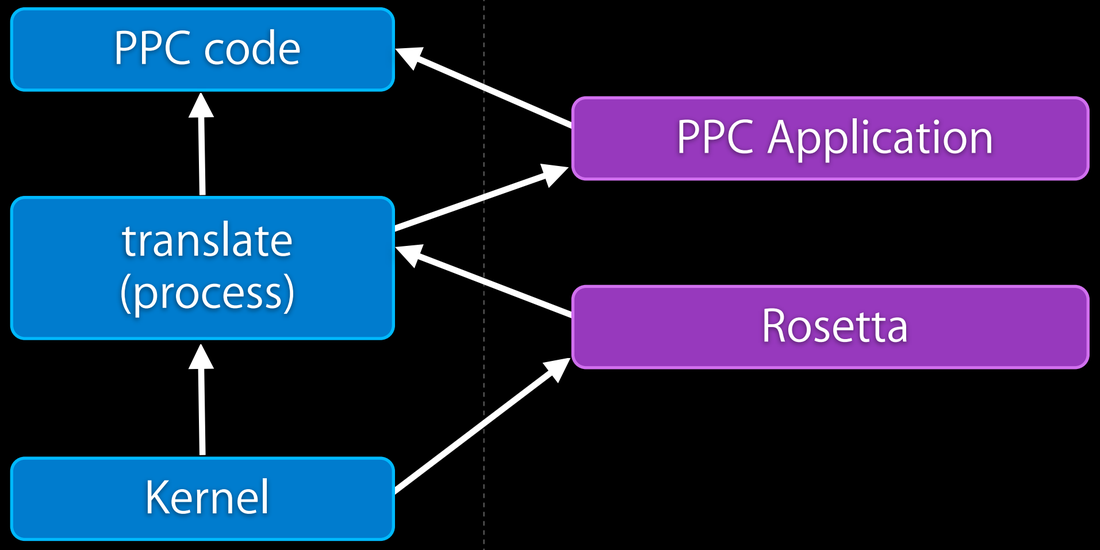
Static code

- Kernel hosts Mail.app



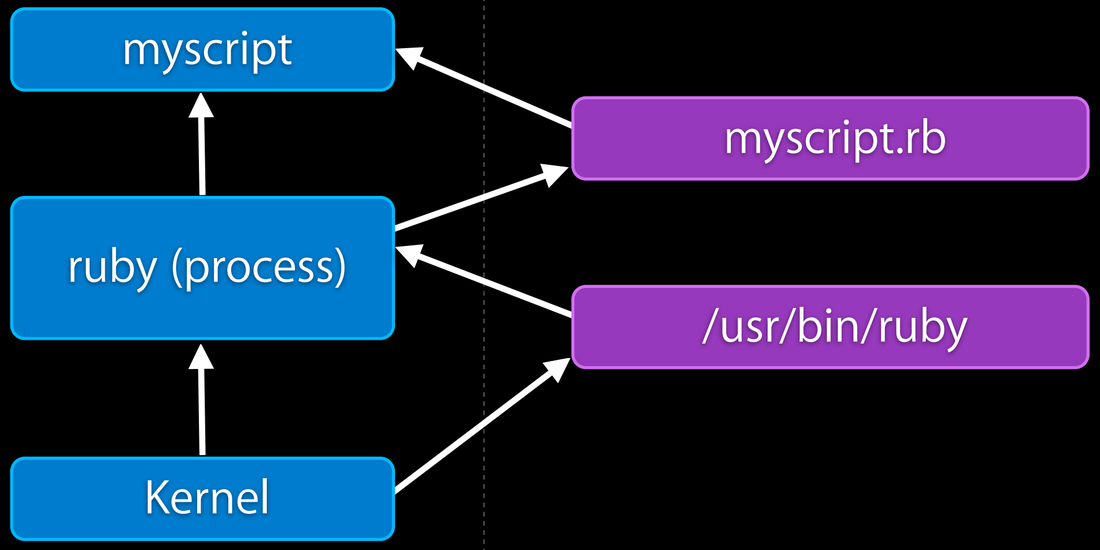
Code Hosting

- Kernel hosts Rosetta
- Rosetta hosts ppc application



Code Hosting

- Kernel hosts ruby interpreter
- ruby interpreter hosts ruby script

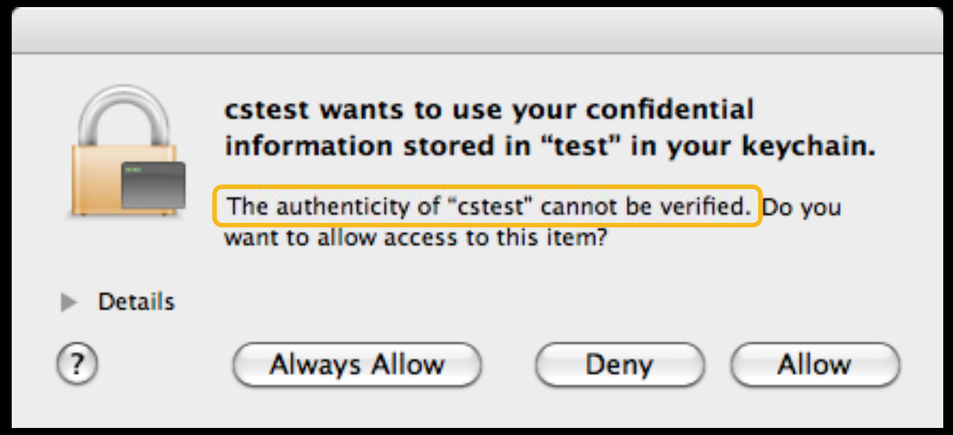


This could be
your customer's script

This could be Your program

What Happens to Unsigned Code?

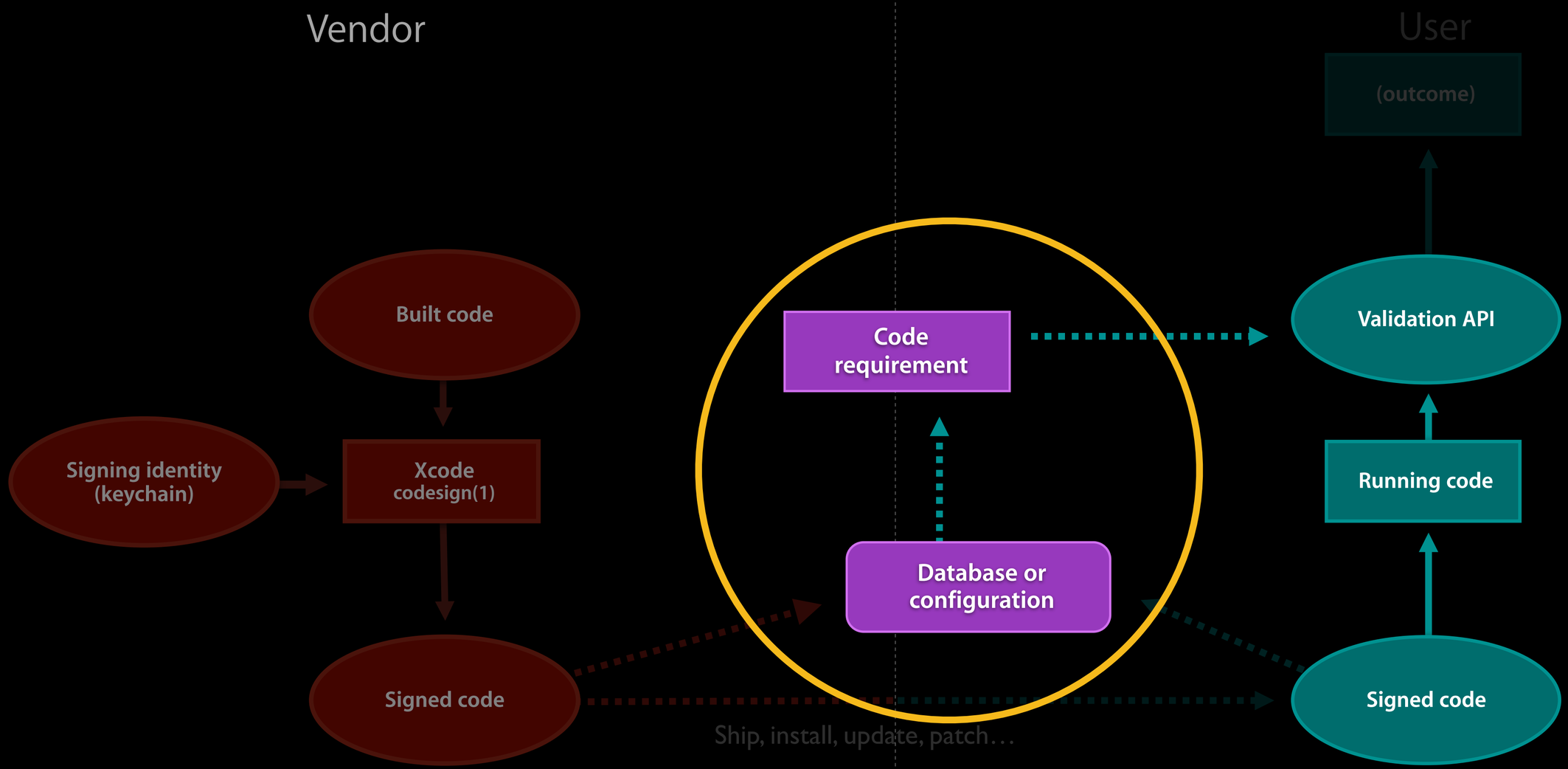
- Unsigned code has no reliable identity
  - Expect dialogs (some are critical)
- May be ad-hoc signed for you
- May be forced onto legacy path
  - Keychain dialogs, no equivalence tracking
- May be rejected outright
- Updates aren't recognized



What Happens if a Signature Breaks

- Broken code has no identity at all
  - Can’t trade on its identity
  - Can’t create keychain items
- No automatic repair
- Remedies
  - Statically invalid: Reinstall
  - Dynamically invalid: Relaunch (and don’t do that again)

Case Studies

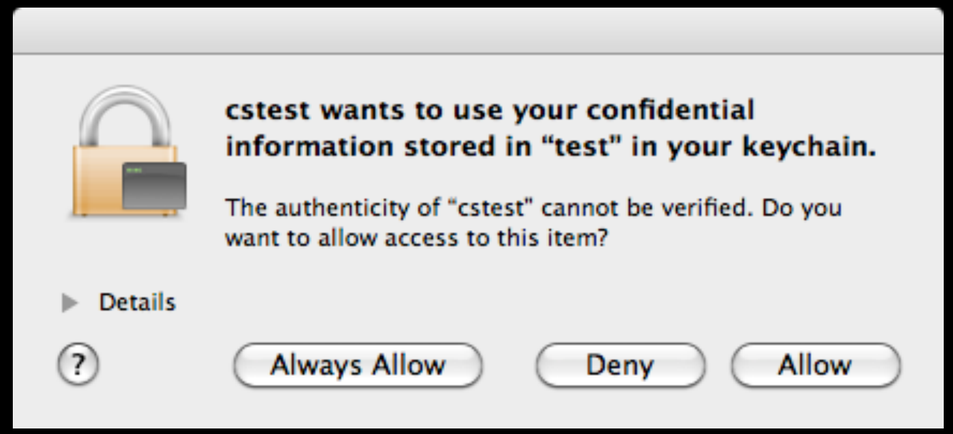


Case Study: Firewall

- Keep list of allowed applications
- Policy
  - Pre-approve system-trusted signatures
  - Prompt for others and remember
- Storage: system database

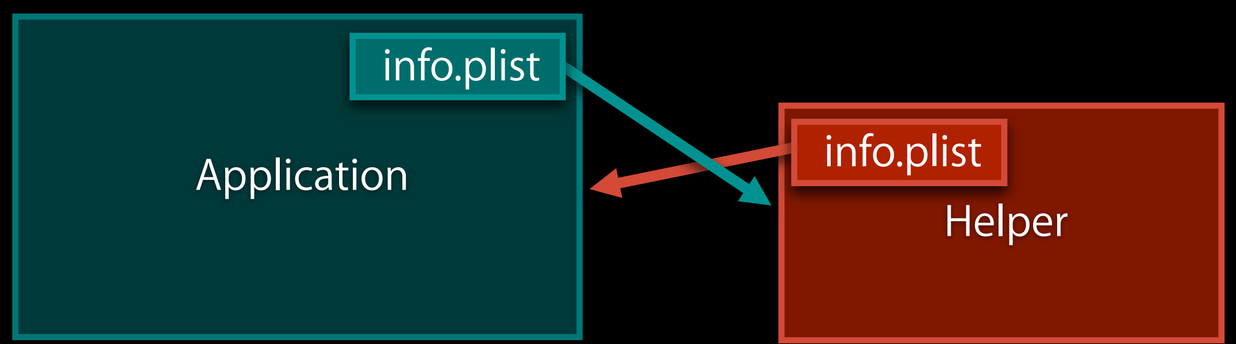
Case Study: Keychain ACLs

- Application list in each keychain item's ACL
- Policy: Explicit (list of code requirements)
  - From Designated Requirement of applications
  - Explicitly specified
- Storage: Embedded in ACL
  - Secured by keychain's security features



Case Study: Service Manager

- Application/Helper identify each other using code requirements
- Policy: Explicit
- Storage: In Info.plists



Signing Identities

- Industry-standard format (RFC 2459 et al)
- Sources
  - Make your own (Certificate Assistant, openssl, …)
  - Commercial CAs (Verisign, Thawte, …)
  - Apple (for iPhone development only)
- Stored as a Keychain Identity
  - Key + Certificate (“My Certificates”)
  - Transmit using PKCS12 (.p12) files

Ad-Hoc Signing

- Most specific identity possible (“just this program”)
- Automatically applied by system
  - Parental controls
  - Firewall
- Architecture specific(!)
- May modify your program
- Cannot track updates

API

- New for Snow Leopard
- Client API
  - Gate access controls by code identity
  - Validate integrity of requesting code
  - Remember code identity for later
- Hosting API
  - Describe and manage hosted code for system
  - Share your (host's) execution with its guests
- Signing API—not yet—use codesign(1)

API

- CoreFoundation Objects
  - SecCodeRef—Running code
  - SecStaticCodeRef—Code on disk
  - SecRequirementRef—Code requirements
- Code objects are local, representing global things
- Validation in each client space

How to Get into Trouble

- Put code into a bundle's Resources directory
- Change code after signing it
  - Post-build mastering
  - Resource files
  - Outsourced localization
- Selective installs
- Symbolic link trickery
- Self-modifying code

More Information

Craig Keithley
Technology Evangelist
keithley@apple.com

man codesign(1)

man csreq(1)

Documentation
http://developer.apple.com/documentation/MacOSX/Conceptual/CodeSigningGuide
http://developer.apple.com/technotes/tn2007/tn2206.html
https://developer.apple.com/snowleopard/library/documentation/Security/Reference/CodeSigningRef/Reference/reference.html
http://developer.apple.com/documentation/developertools/Conceptual/XcodeBuildSystem

Related Sessions

Managing User Privileges and Operations with Authorization Services	North Beach Wednesday 3:30PM
iPhone Security Best Practices	Mission Wednesday 5:00PM
Managing Processes with launchd	Russian Hill Friday 2:00PM

Labs

Mac OS X Security Lab	OS X Lab A Wednesday 12:00PM

Summary

- Code Signing is about identity of code
- You define your program's identity
- The end-system's user/administrator makes the decisions
- Sign your code now
  - If you ship unsigned code, you are late

Q&A

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